State of New Hampshire

Inter-Department Communication

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At (Office): Environmental Services
Watershed Management

Subject: Summary and Results of Level 1 Landscape Level Wetlands Assessment

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Introduction

The DES Watershed Management Bureau and Wetlands Bureau have completed a Level 1 Landscape Assessment of the state's wetland resources. This effort was conducted to achieve goals outlined in the New Hampshire Water Monitoring Strategy (2005) and the EPA's Elements of a State Water Monitoring and Assessment Program for Wetlands (2006). The goal of this Level 1 Assessment was to conduct a landscape level assessment of the state's wetlands using a GIS model and to make preliminary determinations as to what wetlands were likely adequate to support aquatic life and to identify those that were potentially not supporting.

Project Goals and Objectives

- Create wetland assessment units
- Create a buffer area around each wetland assessment unit that can be analyzed to determine what landscape types comprise the buffers.
- Create an index to assess the ecological integrity of the buffer areas based on the relative impact of each of the landscape types identified in the buffers.
- Based on the index developed identify a threshold between potentially support and potentially not supporting for aquatic life use support.
- Evaluate the condition of the wetland buffer, apply the index of ecological integrity, and determine potential aquatic life use support status.
- Summarize the results of the analysis and include the results in the 2008 305(b) report.

Methods

Create Wetland Assessment units

National Wetlands Inventory (NWI) polygons were used as the base for identifying individual wetlands and aggregating them into assessment units. NWI polygons were aggregated due to the large number of individual units (N = 83,565). NWI polygons identified via Cowardin classification as lacustine/limnetic, palustrine/open water, marine/subtidal, estuarine/subtidal, and riverine were removed from the population as they are already identified as open water lake, riverine, or estuarine assessment units. The remaining NWI polygons were amalgamated into assessment units based on methods used by the New Hampshire Fish and Game Department's Wildlife Action Plan (2005). A 125m buffer was created around all NWI polygons. Overlapping buffers were then merged into a single buffer complex. These distances are intended to reflect the distance at which biological communities are likely overlapping and traveling between individual NWI polygons. The buffer complexes and base NWI polygons were then split if bisected by a road or a HUC 12 divide. The split due to roadways ties back to the ability of biological communities to move from wetland to wetland. The HUC12 split was largely an administrative action to allow categorization of the final product to be produced. After the splits, each complex was assigned a unique Assessment Unit ID (AUID) based upon the HUC 12's within which they resided. Finally the AUIDs were transferred from the buffer complexes to all of the NWI polygons within the complexes. The Cowardin classification information attached to each NWI polygon was retained thus allowing for the identification of each Cowardin type within each assessment unit.

Create AUID Buffers for Landscape Level Assessment

A 125m buffer was created around each wetland assessment unit. This second set of buffers did not include the area for its own wetland AUID but could include the area of a separate wetland AUID. That is, it you had two wetland AUIDs bisected by a roadway but otherwise right next to one another each wetland would be included in the landscape assessment for its neighbor but not for itself. It is these buffers that were evaluated based on landcover types and their corresponding impact on the ecologic communities that

reside within the wetland proper. New Hampshire's Consolidated Assessment and Listing Methodology (CALM) (DES 2008) identifies designated uses for New Hampshire's surface waters. This landscape level assessment is based upon the aquatic life designated use and is intended to identify those wetlands that are likely or unlikely to provide suitable conditions for supporting a balanced, integrated and adaptive community of aquatic flora and fauna. The assessment is based on the idea that the condition of a wetlands buffer will be a major driver of the condition of the wetland. Further, we can systematically estimate the condition of the buffer by knowledge of the landcover types within that buffer. Due to the inherent roughness of a landscape level analysis and that no in-wetland measurements were conducted no definitive support categories were made. Based upon the results of the analysis the use support category "potentially supporting" or "potentially not supporting" will be assigned to each assessment unit.

Evaluation of Buffer Landcover Types

The 2006 National Land Cover Data (NLCD) was used to identify landscape types within each wetland buffer area. The 2006 NLCD is based on Landsat Thematic Mapper Imagery (30m resolution) collected from June 1999 through October 2003. The New Hampshire NLCD was imported into ArcView (9.2) and then used to determine what percent of the buffer is comprised of each of the NLCD landcover types. Once the analysis was complete on all 23,626 wetland assessment unit buffers the resulting summary was converted to an Excel format for further analysis.

The Center for Watershed Protection's Stormwater Managers Resource Center (SMRC) has developed The Simple Method for estimating stormwater runoff, pollutant loading, and the resulting impacts to the ecological integrity of 1st through 3rd order streams. Although this model was not designed specifically for wetlands it is reasonable to concur that the ecological integrity of wetlands will also degrade as impervious surface cover degrades supporting habitat and pollutant loadings increase. The SMRC Simple Method was used to estimate the impact of each landscape type and its corresponding impact on the ecologic health of the parent wetland. The Simple Method provides event mean concentration values for numerous pollutants and various landcover types. (Table 1)

Table 1. Event Mean Concentration Value by Landcover Type (Center for Watershed Protection)

Pollutant	Forest/Rural Open	Water Wetland	Agriculture and Pasture	Commercial	Highway	Industrial	Medium Density Residential	Urban Open
BOD	3.0	3.5	5.5	14	17	15.3	27	7
COD	36.5	11.5	53.0	60.6	103	85	98	43
TSS	77.5	11.5	142.5	67.3	141.5	110.3	85	82.5
TDS	415.0	12.0	415	174	294	202	144	415
TP	0.12	0.055	0.705	0.23	0.39	0.24	0.43	0.205
DP	0.035	0.025	0.09	0.11	0.22	0.43	0.2	0.07
TKN	0.825	0.695	1.64	1.31	1.8	2.08	2.57	1.25
NO2/NO3	0.67	0.595	4.06	0.81	0.83	1.5	1.27	0.775
Pb	0.27	0.009	-	0.068	0.17	0.28	0.84	0.05
Cu	-	0.006	-	0.049	0.04	0.076	0.033	0.027
Zn	0.142	0.05	-	0.18	0.21	0.502	0.158	0.083
Cd	-	0.001	-	0.003	0.003	0.005	0.004	0.001
Fecal Coliform	300	300	3250	4736	600	1022	11954	3250
E. coli	-	-	-	-	-	-	38607	-

The landscape types used in the NLCD and the Simple Method did not correlate exactly so land use types were matched as closely as possible between the two datasets. In some cases landcover types were combined and in all cases landcover types were weighted by estimates of impervious surface cover (Table 2). The overall NLCD landcover type "developed" was correlated to the average of the SMRC landcover types that comprise developed lands; commercial, highway, industrial and medium density residential. A percent impervious surface value was then assigned to each NLCD landcover type based on information provided with the NLCD dataset that assigns a range of impervious surface cover for each landcover type. For purposes of calculating pollutant loads the highest value in each impervious surface cover range was used. Incorporating impervious surface coverage into the pollutant loading calculation will compensate for using the same average of SMRC landcover types for the low, medium, and high NLCD landcover classes.

Table 2. Translation of SMRC Landcover Types to NLCD Landcover Types

NLCD Landcover Type	SMRC Landcover Types and EMC's Assigned	Assigned % Impervious Surface
High Intensity Developed	AVERAGE (Commercial, Highway, Industrial, Med. Density)	100
Medium Intensity Developed	AVERAGE (Commercial, Highway, Industrial, Med. Density)	79
Low Intensity Developed	AVERAGE (Commercial, Highway, Industrial, Med. Density)	49
Open Space Developed	Urban Open	20
Cultivated	Agriculture and Pasture	15
Pasture/Hay	Agriculture and Pasture	15
Grassland	Agriculture and Pasture	15
Deciduous Forest	Forest/Rural Open	0
Evergreen Forest	Forest/Rural Open	0
Mixed Forest	Forest/Rural Open	0
Scrub/Shrub	Forest/Rural Open	0
Palustrine Forested Wetland	Water/Wetland	0
Palustrine Scrub/Shrub Wetland	Water/Wetland	0
Palustrine Emergent Wetland	Water/Wetland	0
Estuarine Emergent Wetland	Water/Wetland	0
Unconsolidated Shore	Water/Wetland	0
Bare Land	Water/Wetland	0
Water	Water/Wetland	0
Palustrine Aquatic Bed	Water/Wetland	0
Estuarine Aquatic Bed	Water/Wetland	0

For each NLCD landcover type an annual pollutant load was calculated (Formula 1).

Formula 1. Calculation of annual pollutant load using event mean concentrations and % impervious surface

$$L = 0.226 * R * C * A$$

Where:

L = Annual load in lbs (Table 1 values converted from mg/L to lbs)
R = Annual runoff
C = Pollutant Concentration
A = area (acres)
0.226 = unit conversion factor

A more detailed explanation of the Simple Method can be found at http://www.stormwatercenter.net/

Assuming the land use with the highest pollutant loading would correlate to the most degraded surrounding habitat and cause the most impairment an initial scoring system was developed using the landscape type with the highest loading (Developed High Intensity =

100). A load ratio was then calculated by dividing the pollutant load for each NLCD landcover class by the pollutant load for Developed High Intensity and then multiplying by 100. This allows for all pollutant loads to be in relation to the land use with the highest pollutant load ratio and to be on a scale of 0 – 100.

An additional calculation was done to correct the load ratios for "natural" loadings which were assumed to be the pollutant loads associated with forested NLCD landscape types. This adjusts the pollutant load ratio for forested landscape types to zero and subtracts natural loadings for the remaining NLCD landscape types. The resulting adjusted load ratio was then assigned as the "score" for each landscape type (Table 3).

Table 3. Level 1 Assessment Scores

NLCD Landcover Type	Assessment Score	Impervious Cover Fraction	% Buffer Occupied by Landcover Type @ PNS Threshold
High Intensity Developed	100	1	10
Medium Intensity Developed	79.6	0.79	13
Low Intensity Developed	50.5	0.49	20
Open Space Developed	12.0	0.2	84
Cultivated	15.6	0.15	63
Pasture/Hay	15.6	0.15	63
Grassland	15.6	0.15	63
Deciduous Forest	0	0	-
Evergreen Forest	0	0	-
Mixed Forest	0	0	-
Scrub/Shrub	0	0	-
Palustrine Forested Wetland	0	0	-
Palustrine Scrub/Shrub Wetland	0	0	-
Palustrine Emergent Wetland	0	0	-
Estuarine Emergent Wetland	0	0	-
Unconsolidated Shore	0	0	-
Bare Land	0	0	-
Water	0	0	-
Palustrine Aquatic Bed	0	0	-
Estuarine Aquatic Bed	0	0	-

The following formula was used to calculate the overall Level 1 Assessment Score for each wetland AUID buffer area:

Level 1 Assessment Score = Σ %LCi * LCSi
where:

%LC = percent of the total area in a given land cover class

LCS = Assessment score for given land cover class

In order to identify wetland assessment units as potentially supporting or potentially not supporting for the aquatic life designed use a threshold was needed for the Level 1 assessment scores. Both the Center for Watershed Protection and DES have determined that once a watershed area exceeds 10% impervious surface cover exceedences of water quality criteria are likely. Thus, if a wetland buffer is comprised of 10% or greater of the "high density developed" NLCD landcover class, that wetland assessment unit is very likely to have violation of water quality standards. Based upon the 10% threshold, any wetland assessment unit with a Level 1 score exceeding 10 will be listed as potentially not supporting. Table 3 indicates the percent of a given buffer that would need to occupied by each NLCD landcover class to exceed the potentially not supporting threshold of 10.

Level 1 Assessment Score <10	**AUID listed as Potentially Supporting**
Level 1 Assessment Score >10	**AUID listed as Potentially Not Supporting**

Results and Discussion

Figure 1 shows the distribution of the resulting scores from the Level 1 assessment. A total of 18,909 (80.0%) wetland assessment units were assessed as potentially supporting and 4,717 (20.0%) as potentially not supporting. Figure 2 shows a distribution of how the potentially supporting and potentially not supporting wetland assessment units are geographically distributed. Results of the Level 1 assessment including both the Level 1 Assessment Score and the relationship to the potential support threshold, will be imported into the DES Supplemental Assessment Database and consequently included in the 2008 305(b) report to EPA.

Figure 1. Distribution of Level 1 Wetland Assessment Score

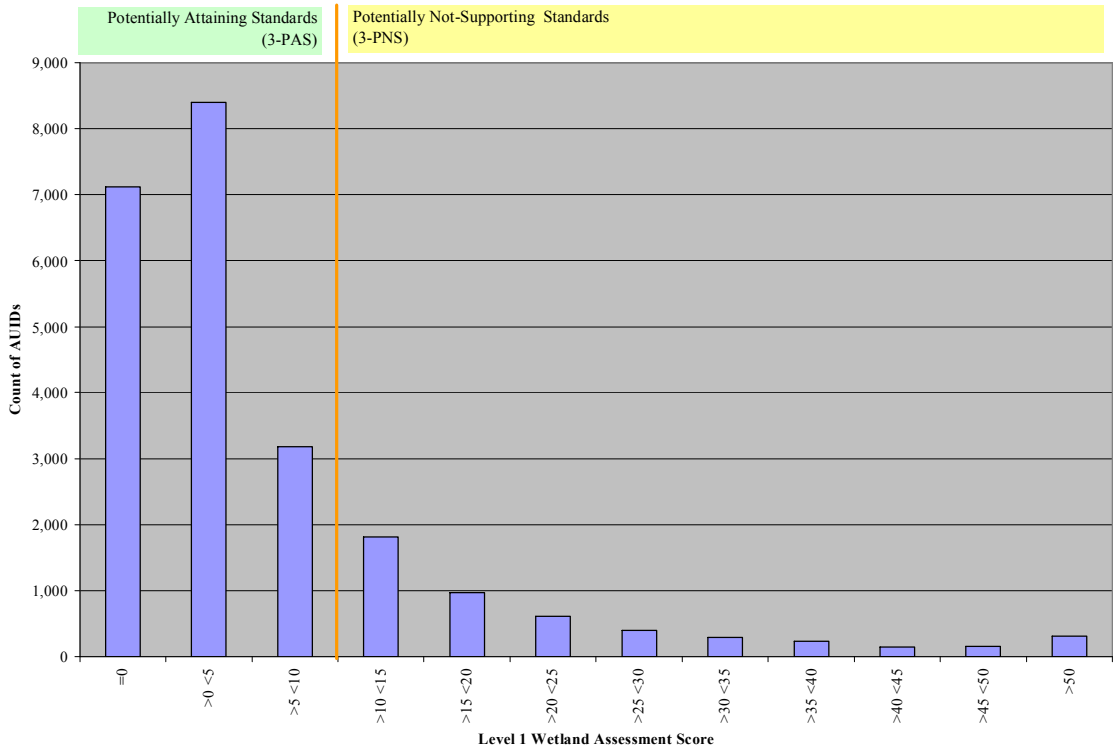

Figure 2. Distribution of Level 1 Wetland Assessment Score 305(b)